Amendments to the Drawings

Fig. 4 has been amended to correspond with amendments made in the specification. Specifically, new reference number 232 has been added to distinguish from reference number 215. No new matter has been added.

Attachment: Replacement Sheet
Annotated Marked-Up Drawings

REMARKS

Claims 1-50 are pending, and Claims 4, 6, 11-15, 20-24, 26-29, 30-36, 38 and 41-48 are withdrawn as being directed to a non-elected invention.

In the Office Action, Claims 1-3, 5, 7, 8, 10, 16-19, 25, 37, 39, 40, 49 and 50 were rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. 3,541,729 to Dantowitz ("Dantowitz"). Claims 1, 17 and 18 were rejected under 35 U.S.C. § 102(b) as being anticipated by WO 98/08771 to Clawson ("Clawson"). Claim 8 was rejected under 35 U.S.C. § 112, ¶ 2 for indefiniteness.

The specification was objected to because reference number 215 was used to refer to two elements. The specification and drawings have been amended to correct this informality. Reference number 215 now refers to the expansion bellows, and new reference number 232 is used for the coiled tubes. In the drawings, Fig. 4 has been amended to correspond with this change.

Claims 37-39 have been cancelled without prejudice toward their re-submission in this or any continuing applications.

Claim 8 has been amended to specify that the oxygen-containing gas is preheated in "the second zone." With this amendment, it is believed that the indefiniteness rejection is overcome.

Claim 27 has been amended to depend from Claim 25, which is an elected claim. With this amendment, it is believed that Claims 27-29 should be re-joined for examination.

Claim 40 has been amended to specify a "first exothermic reaction" and a "second exothermic reaction," and that "both the first exothermic reaction and the second exothermic reaction occur within the plurality of nested shells." Support for this amendment can be found in the present application at, for example, Figs. 2 and 4, and in the related text of the Specification.

No new matter has been added by way of the present amendments.

The rejection of Claim 1 is traversed on the ground that the cited Dantowitz and Clawson references fail to teach or suggest the limitations of Claim 1.

The Dantowitz patent describes a reformer unit having a hot fluid source 3, a reaction sub-assembly 5 and a boiler sub-assembly 7. The reaction sub-assembly includes a catalyst bed for performing steam reforming of a fuel and steam mixture, where the catalyst bed is indirectly heated by hot fluids from the hot fluid source. The hot fluid is then passed into indirect heat

transfer relation with a water reservoir in the surrounding boiler sub-assembly to produce steam. The water reservoir is also heated by indirect heat transfer from the reformed fuel. The steam thus produced mixes with fuel to form the fuel and steam mixture for steam reforming. (See, e.g., Abstract, Fig. 1).

The Dantowitz patent is different from the reactor recited in Claim 1 in several important aspects. Applicants submit that Dantowitz lacks the presently-claimed "core reaction zone," because although Dantowitz describes an exothermic reaction (*i.e.* combustion) within the hot fluid source 3, the burner that performs the exothermic reaction is located below the main body of the reactor (see Fig. 1), and does not meet the limitation of the "core reaction zone" having shells arranged coaxially about the core reaction zone. (In Dantowitz, the innermost co-axial "zone" is the "introductory passage segment 115," which is merely a conduit for hot fluids, and does not conduct any exothermic reactions).

Even assuming that Dantowitz does have a "core reaction zone," Dantowitz still fails to teach or suggest the limitation that "hydrocarbon feed stock is preheated from about its storage temperature substantially to its desired preheat temperature by traversing a first zone." As further defined in Claim 1, the "first zone" is a "coaxial zone" formed by shells that are arranged coaxially about the core reaction zone. Dantowitz has no such "coaxial zone." In Dantowitz, the reactant ("feed stock") enters at the top of the reactor through inlet conduit 21, and is immediately directed to the catalyst bed 31 in the concentric "zone" formed between walls 13 and 19. To the extent the reactant in Dantowitz is pre-heated from about its storage temperature substantially to its desired preheat temperature, this does not occur by "traversing a first zone," as is presently recited.

Furthermore, Dantowitz clearly fails to teach or suggest the limitation that "an oxygen containing gas is preheated from about its storage temperature substantially to its desired pre-heat temperature by traversing a second zone." Dantowitz does not discuss preheating an oxygen-containing gas at all. In the Office Action, the Examiner takes the position that the "burning" of oxygen in the burner 3 meets the limitation of preheating an oxygen containing gas by traversing a second zone. Applicants respectfully disagree. First, the burner 3 of Dantowitz is clearly not a "coaxial zone" as that term is defined in present Claim 1. As previously noted, the burner 3 is located below the main body of the reactor, and does not constitute a "zone" that is formed

between adjacent shells that are arranged coaxially about a core reaction zone. Furthermore, if the burner is construed as the presently-claimed "second zone," this is wholly inconsistent with the remainder of Claim 1, since the burner is the only location in Dantowitz where exothermic reaction(s) occur, and Claim 1 specifies that an exothermic reaction occurs in the "core reaction zone." However, Claim 1 is clear that the "core reaction zone" cannot simultaneously be the "second zone," since the second zone is formed by shells that coaxially surround the core reaction zone. Thus, the burner of Dantowitz cannot be both the "core reaction zone" and the "second zone" of Claim 1, as the Examiner asserts.

Finally, applicants submit that the burning of oxygen containing gas in the burner does not constitute "pre-heating" of the gas, since during combustion, the oxygen in the gas is entirely consumed, not "pre-heated."

For the above reasons, it is believed that the rejection of Claim 1 for anticipation by Dantowitz is overcome.

The deficiencies with respect to the Dantowitz reference are not overcome by the cited Clawson reference. Clawson, like Dantowitz, fails to teach or suggest several limitations of Claim 1. Clawson discusses a reactor having a central zone that conducts an exothermic reaction (i.e. partial oxidation zone 24). However, Clawson fails to teach or suggest the "first zone" and "second zone" as defined in Claim 1. Clawson does describe a region between the "first vessel 18" and the "second vessel 58" that includes a helical tube 32. An oxygen containing gas flows through the helical tube from an oxygen source 42 to the inlet of the first vessel 18. Gaseous products from the first vessel flow within this region and over the helical tube 32. At the very end of the tube 32, near the point where the tube empties into the first vessel 18, steam and fuel are injected into the tube, where they mix with the oxygen-containing gas prior to entry into the partial oxidation zone 24.

Clawson does not teach or suggest that "hydrocarbon feed stock is preheated from about its storage temperature substantially to its desired preheat temperature by traversing a *first zone*, and an oxygen containing gas is preheated from about its storage temperature substantially to its desired preheat temperature by traversing a *second zone*." (Emphasis added). Although the region between the first vessel 18 and the second vessel 58 containing the helical tube could be considered a "second zone" where oxygen containing gas is preheated, there is nothing

corresponding to the "first zone" as recited in Claim 1. There is no coaxial "zone" where hydrocarbon feed stock is preheated from about its storage temperature substantially to its preheat temperature in Clawson. Arguably, the hydrocarbon feed stock is preheated when it is injected into the helical tube 32 just prior to its entry into the partial oxidation zone 24. However, to the extent this might satisfy the "zone" limitation of present Claim 1, this is the same "zone" through which the oxygen containing gas traverses. Claim 1 specifies two separate coaxial zones: a first zone for preheating hydrogen feed stock, and a second zone for preheating oxygen containing gas, and is thus clearly distinguishable from Clawson. Accordingly, it is believed that the rejection of Claims 1, 17 and 18 for anticipation by Clawson are overcome.

In view of the above comments, it is believed that the rejections of independent Claim 1 are overcome, and that this claim, and its dependents, Claims 2-3, 5, 7, 8, 10 and 16-19, are all allowable. Applicants further request re-joinder and allowance of non-elected Claims 4, 7, 9 and 11-15, which all depend, directly or indirectly, from generic Claim 1.

Turning now to independent Claim 25, the Examiner rejected this claim for anticipation by Dantowitz. This rejection is traversed on the ground that Dantowitz fails to teach or suggest all the limitations of Claim 25. Specifically, Claim 25 recites a reactor having, *inter alia*, a plurality of coaxial zones, including a first zone configured to conduct steam reforming and an exothermic reaction (one or more of combustion, partial oxidation, autothermal reforming, water gas shift and preferential oxidation), a second zone for preheating hydrocarbon feed stock, and a third zone for preheating oxygen gas. As previously discussed in connection with Claim 1, Dantowitz does not disclose a coaxial zone for pre-heating hydrocarbon feed stock, nor does Dantowitz disclose a coaxial zone for preheating oxygen containing gas. In addition, Dantowitz does not teach or suggest the "first zone" as recited in Claim 25, which is configured to conduct steam reforming and an exothermic reaction. Dantowitz has a innermost zone that includes hot products of an exothermic reaction (though the reaction itself occurs in burner 3 located below the main body of the reactor). Dantowitz also has a different concentric "zone" between cylindrical walls 13 and 19 that contains a catalyst 31 for steam reforming. However, Dantowitz does not teach or suggest a single zone for conducting both steam reforming and an exothermic reaction, as is recited in Claim 25. Accordingly, it is believed that the Examiner's rejection of Claim 25 for anticipation by Dantowitz is overcome, and Claims 25 and its dependents, Claims

27-29, are all allowable. Applicants further request re-joinder and allowance of non-elected Claim 26, which depends on allowable generic Claim 25.

Turning now to independent Claim 40, the Examiner rejected this claim for anticipation by Dantowitz. This rejection is traversed on the ground that Dantowitz fails to teach or suggest all the limitations of Claim 40. Specifically, Claim 40 has been amended to specify a "first exothermic reaction" and a "second exothermic reaction," and that "both the first exothermic reaction and the second exothermic reaction occur within the plurality of nested shells." Dantowitz fails to teach or suggest this limitation, since the only exothermic reaction conducted in the reformer assembly of Dantowitz is the combustion reaction conducted by burner 3. Dantowitz fails to teach or suggest a "second exothermic reaction" that "occur[s] within the plurality of nested shells." Accordingly, it is believed that the rejection of Claim 40 is overcome, and that this claim should be allowed. Applicants further request re-joinder and allowance of non-elected Claim 41, which depends on allowable generic Claim 40.

Turning now to independent Claim 49, the Examiner rejected this claim for anticipation by Dantowitz. This rejection is traversed on the ground that Dantowitz fails to teach or suggest all the limitations of Claim 49. This claim specifies that the reactor has a first coaxial zone containing a steam reforming and/or shift catalyst, a second coaxial zone that preheats a hydrocarbon feed stock, and a third coaxial zone that preheats an oxygen containing gas. As previously discussed in connection with Claim 1, Dantowitz does not meet the limitations of a zone for preheating a hydrocarbon feed stock, and a zone preheating an oxygen containing gas. Accordingly, it is believed that Claim 49 is allowable.

Turning now to independent Claim 50, the Examiner rejected this claim for anticipation by Dantowitz. This rejection is traversed on the ground that Dantowitz fails to teach or suggest all the limitations of Claim 50. Specifically, Claim 50 specifies a core reaction zone configured to conduct at least one exothermic reaction and at least one fuel reforming reaction. As previously discussed in connection with Claim 25, Dantowitz does not disclose a reactor having a zone for conducting both an exothermic and a fuel reforming reaction.

Moreover, Claim 50 further specifies at least three shells arranged concentrically about the core reaction zone defining a plurality of coaxial zones, and at least three fluid flows, each in a different coaxial zone, where two of the fluid flows comprise a reactant that is pre-heated from

an initial temperature to a second temperature suitable for reaction by traversing a coaxial zone. In the Office Action, the Examiner asserts that the water 121 in the boiler sub-assembly 7 and the reformate 131 that flows in the gap between walls 85 and 71 constitute "reactants" that are pre-heated as specified in Claim 50. Applicants disagree, since the reformate 131 that flows through the gap between walls 85 and 71 is actually cooled from a high-temperature to "a level which can be tolerated by a fuel cell," and thus is not "pre-heated" as recited in Claim 50. (See Dantowitz at col. 6, lines 4-10). Accordingly, it is believed that the rejection of Claim 50 is overcome, and that this claim is allowable.

In view of the above remarks, Applicants respectfully request reconsideration of the Restriction Requirement dated 8, 2005, and rejoinder of the non-elected claims in this application. In particular, applicants request rejoinder of the claims corresponding to non-elected species a-1, which include, in addition to the claims dependent on allowable generic claims as previously discussed, Claims 20, 30-32 and 42-48. It is submitted that these claims are all allowable over the cited references for substantially the same reasons as pending Claims 1, 25, 40, 49 and 50.

CONCLUSION

In view of the above amendments and remarks, it is believed that all claims are in condition for allowance, and it is respectfully requested that the application be passed to issue. If the Examiner feels that a telephone conference would expedite prosecution of this case, the Examiner is invited to call the undersigned.

Respectfully submitted,

HAMILTON, BROOK, SMITH & REYNOLDS, P.C.

By _____

Kevin T. Shaughnessy
Registration No. 51,014
Telephone: (978) 341-0036
Facsimile: (978) 341-0136

Concord, MA 01742-9133
Dated: 5/14/06

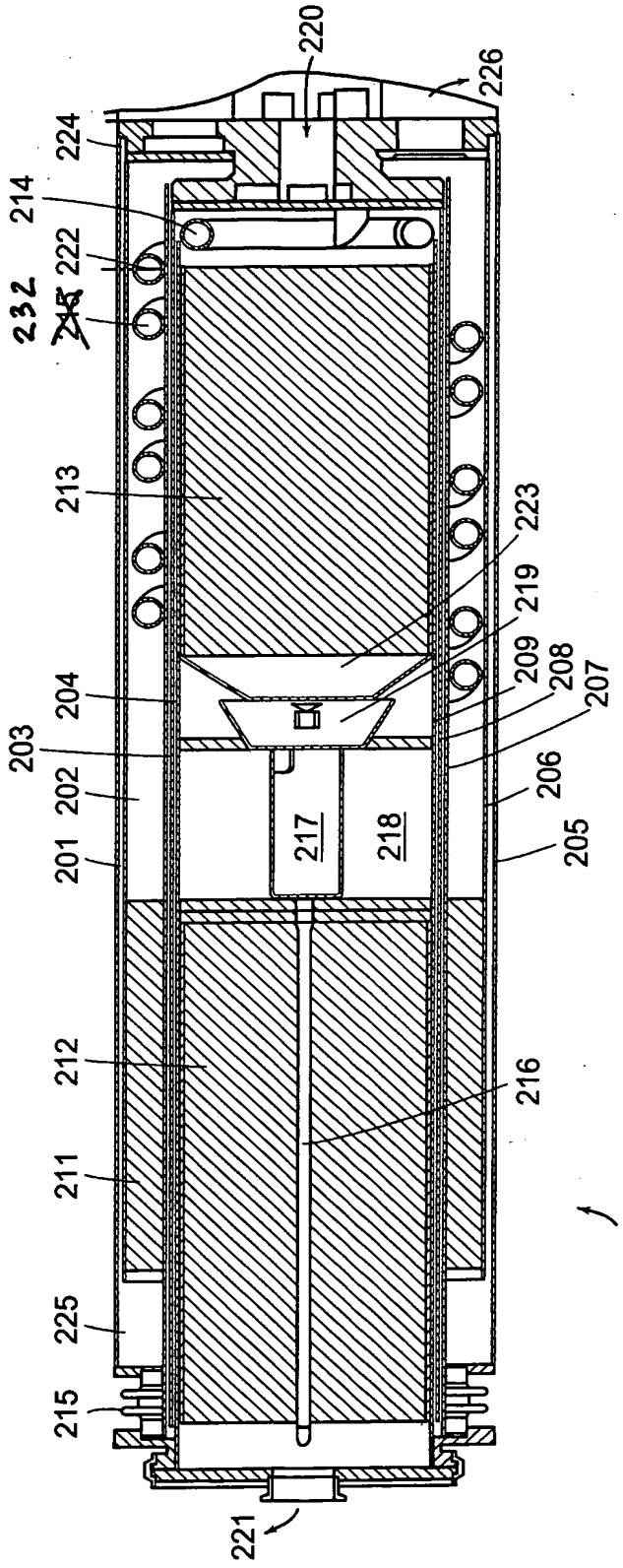

FIG. 4